New CCD Photometry Study of RV UMa

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Abstract

All available CCD observation of RV UMa have been analyzed to obtain an accurate mathematical description of the ligh variation. We discuss in this paper a new study of variable star RV UMa, a short period RRab star, in orther to determine through the light curve and the physical parameters, the presence of *"Blazhko effect"*. The Star were observed for a total of 839 sessions shooting, and exhibits light curve modulation with the shortest modulation Period=0^d.468002 ever observed. The result detect small but definite modification in temperature and mean radius of the star itself. All results are compared with previously published literature values and discussed.

Keyword: Stars: individual: RV UMa - Stars: variables: RV UMa - Stars: oscillations - Techniques: photometric
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1 Introduction

RV UMa is a RR Lyr type variable star (RRab type) in the constellation of Ursa Major, located (R.A. 13°33' 18.09", Decl. +53°59' 14.6"), and it has this parameter:

V_M range: 9.81 - 11.3
Spectral type: A6-F5
Orbital Period: P= 0^d.46806.

RR Lyrae is a particular type of variables stars with asymmetric light curves (steep ascending branches), periods from 0.3 to 1.2 days, and amplitudes from 0.5 to 2 magnitude in V. This phenomenon of modulated light variation is called *Blazhko effect*.

2 Data

2.1 Observations

The stars was observed in 2011 April and May (UT) and all data were obtained with the Richey-Chretien telescope of the TS Corporation on Andrate (TO) - Italy station, equipped with a CCD camera (FLI EEV2 back illuminated, 2048×2048 pixel mm 0,39 arcsex/pix) with V filters (Johnson-Kron-Cousins [1], as a good quality, homogeneous set with an accuracy of 0.01 - 0.02 mag.
Fig. 1 show the identification map for the stars RV UMa and Ref used in this study.
Table 1 show the RV UMa data by C.D.S. - SIMBAD, Table 2 show the journal book of observations and capture image. We do not indicate the values of the Dark Frame as the CCD is cooled to liquid nitrogen,

and therefore there were no shooting Dark. Preliminary processing of all CCD frames, to apply bias and flat field corrections, was alone with standard routines in the IRAF software package.
The magnitudes of stars in the Table 3, 4, 5, 6, 7, 8 and 9 are computed by fitting the position and scale of the PSF to each star image in turn, in order of decreasing brightness. The Zero Point of the frame is set during the PSF calculation, thought aperture photometry of the stars used to calculate the PSF.

2.2 Transformations and Reductions

Instrumental magnitudes for all measured stars were transformed to a standard system using fitting coefficients derived from observations of standard stars whose magnitudes have been well established in earlier studies[2].
The standard data for RV UMa and Ref used in this study, are visible in Table 1 from C.D.S. - SIMBAD[5]

2.3 Photometric Error

To determine the error in the measurement of values used the method of the standard deviation. The following table highlights the values obtained in this study:

Data	Photometric Error
Apr 08	0,63
Apr 13	1,41
May 05	-0,08
May 27	-0,69

Photometric error for days

Figures 3, 4, 5 and 6 show the deviation for each observation session for the V band.

2.4 Comparison with Previous Studies

The result of this work study of RV UMa, is comparable with other paper study, and the data has been published in Table 10.

3 Data Analysis

The analysis of the data and their calibration to the international system, are shown by this study in Table 3, 4, 5, 6, 7, 8 and 9.
Column 1 give the number of observation, Column 2 give the Time of observation in JD, Column 3 give the V magnitudo of RV UMa measured for the time in column 2, Column 4, 5 and 6 give the V magnitude data photometry for Star Ref, measured of this study.

3.1 The Light Curve diagrams and Period Data

In Fig. 2 we can show the Light Curve Diagram star for this work. Data analysis in this work allowed to obtain the following result for RV UMa:

Frequence	Amplitude	Phase
1.56302245E+01	1.93041372	0.468002

The LightCurve Diagram for all days of study are show at the end of the paper.

3.2 The Residual Diagrams

The residual curve of all the data (Fig. 8) shows that the distortion is symmetrical to phase 0.468002 which is set to the phase of the middle of the rising branch. Thus the phase on the ascending branch when the visual luminosity of the star equals its time average value (at phase 0.46 in the figures) are closely related, with only some minute differences, to the onset of the H emission.
In Figs. 8 the symmetrical modulation is centred exactly on this phase of the pulsation, indicating a connection between the origin of the modulation and that of the H emission.
At the end of this paper are show the singular LightCurve Diagram and Residual LightCurve Diagram for all day of this study.

3.3 Fourier Diagrams

The Fourier spectra of the V data and the data prewhitened with the pulsation frequency and its harmonics are shown in Fig.7. At the end of the paper are show the singular Fourier diagrams for all day of this study.

4 Conclusion

The study variable RV UMa, has highlighted the presence Blazhko effect especially highlighted in the diagram for the period of analysis, Fig. 2. The data obtained are also in line with the estimates contained in the data AAVSO.[3]
The new results concerning the properties of the modulation of RV UMa are summarized in the next items:

- Residual scatter of the light curve is still concentrated in the ascending branch, indicating some irregular behaviour of the modulation;
- The modulation is concentrated to 0.46 phase interval of the pulsation (Fig.8);
- The symmetrical modulation centred exactly on this phase (0.468002) of the pulsation, indicating a connection between the origin of the modulation and that of the H emission. This is show in Fig.8

Give the importance of this type of stars and their important role in astrophysics not only as basic distance indicator, but also Blazhko effect and because as the most studied star in the pulsation and evolution of Pop II object, and know the still insufficient set of data available, further observations are needed.

5 Acknowledgments

I would like to thank Dr.ssa Silvia Gargano for supporting and helping me during this study, with useful comments and helpful discussions which were extremely valuable. The constructive comments are highly appreciated.

Table 1: The RV UMa Data from C.D.S. - SIMBAD[5]

Star	r	J	H	K	V	Rc	V-Rc
RV UMa	-	10.08	9.83	9.81	10.9	-	-
Ref1	-	-	-	-	12.04	11.58	0.46
Ref2	-	-	-	-	12.56	12.37	0.19
Ref3	-	-	-	-	12.98	12.43	0.55

Table 2: Journal Book of observations and capture image

Data	Sky	Seeing	Moon	Umidity	Filter	Exposition Time	Open Circles	Calibration			
								Dark		Flat Field	
								Number	Time of exposition	Number	Time of exposition
08/04/2011	Clear	7/10	NO	50%	V	120 sec	2, 3 and 7	-	-	30	120 sec
13/04/2011	Clear	3/5	YES	70%	V	120 sec	2, 3 and 7	-	-	30	120 sec
05/05/2011	Clouds	2/5	NO	50%	V	120 sec	2, 3 and 7	-	-	30	120 sec
27/05/2011	Clear	3/5	YES	50%	V	120 sec	2, 3 and 7	-	-	30	120 sec

Table 3: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
1	2455660.491	11.93	0.49	0.50	0.48	86	2455660.646	8.62	0.50	0.51	0.49
2	2455660.493	11.81	0.48	0.49	0.47	87	2455660.648	8.66	0.49	0.50	0.48
3	2455660.495	11.72	0.49	0.50	0.48	88	2455660.651	8.57	0.49	0.50	0.48
4	2455660.496	11.78	0.48	0.49	0.47	89	2455660.652	8.62	0.49	0.50	0.48
5	2455660.498	11.67	0.48	0.49	0.47	90	2455660.654	8.60	0.49	0.50	0.48
6	2455660.5	11.63	0.49	0.50	0.48	91	2455660.656	8.57	0.47	0.48	0.46
7	2455660.501	11.55	0.49	0.50	0.48	92	2455660.657	8.59	0.48	0.49	0.47
8	2455660.504	11.53	0.49	0.50	0.48	93	2455660.659	8.41	0.50	0.51	0.49
9	2455660.506	11.39	0.49	0.50	0.48	94	2455660.661	8.61	0.48	0.49	0.47
10	2455660.508	11.41	0.48	0.49	0.47	95	2455660.662	8.73	0.46	0.47	0.45
11	2455660.509	11.25	0.48	0.49	0.47	96	2455660.664	8.70	0.49	0.50	0.48
12	2455660.511	11.30	0.49	0.50	0.48	97	2455660.667	8.68	0.51	0.52	0.50
13	2455660.513	11.11	0.48	0.49	0.47	98	2455660.669	8.64	0.49	0.50	0.48
14	2455660.514	11.13	0.47	0.48	0.46	99	2455660.67	8.78	0.48	0.49	0.47
15	2455660.516	11.11	0.49	0.50	0.48	100	24556652771554500	12.71	0.48	0.49	0.47
16	2455660.517	11.06	0.48	0.49	0.47	101	24556652788018700	12.64	0.47	0.48	0.46
17	2455660.521	10.99	0.48	0.49	0.47	102	24556652793946100	12.73	0.47	0.48	0.46
18	2455660.522	10.84	0.49	0.50	0.48	103	24556652799997800	12.54	0.48	0.49	0.47
19	2455660.524	10.76	0.49	0.50	0.48	104	24556652807114400	12.64	0.48	0.49	0.47
20	2455660.526	10.82	0.49	0.50	0.48	105	24556652812995600	12.62	0.48	0.49	0.47
21	2455660.527	10.79	0.48	0.49	0.47	106	24556652819602500	12.59	0.47	0.48	0.46
22	2455660.529	10.78	0.47	0.48	0.46	107	24556652825563600	12.62	0.46	0.47	0.45
23	2455660.53	10.71	0.48	0.49	0.47	108	24556652831516600	12.54	0.47	0.48	0.46
24	2455660.532	10.67	0.48	0.49	0.47	109	24556652837517200	12.68	0.47	0.48	0.46
25	2455660.534	10.61	0.49	0.50	0.48	110	24556652843501500	12.61	0.48	0.49	0.47
26	2455660.537	10.51	0.49	0.50	0.48	111	24556652849380300	12.56	0.48	0.49	0.47
27	2455660.539	10.41	0.49	0.50	0.48	112	24556652855661300	12.50	0.48	0.49	0.47
28	2455660.54	10.47	0.49	0.50	0.48	113	24556652862672500	12.53	0.48	0.49	0.47
29	2455660.542	10.47	0.48	0.49	0.47	114	24556652868680000	12.52	0.47	0.48	0.46
30	2455660.543	10.39	0.47	0.48	0.46	115	24556652874699100	12.51	0.46	0.47	0.45
31	2455660.545	10.34	0.48	0.49	0.47	116	24556652880749500	12.54	0.47	0.48	0.46
32	2455660.547	10.20	0.49	0.50	0.48	117	24556652886706400	12.53	0.48	0.49	0.47
33	2455660.548	10.14	0.49	0.50	0.48	118	24556652892637500	12.48	0.48	0.49	0.47
34	2455660.55	10.19	0.49	0.50	0.48	119	24556652898641400	12.49	0.48	0.49	0.47
35	2455660.555	10.18	0.48	0.49	0.47	120	24556652905002400	12.60	0.47	0.48	0.46
36	2455660.556	10.11	0.48	0.49	0.47	121	24556652910727000	12.53	0.47	0.48	0.46
37	2455660.558	9.97	0.49	0.50	0.48	122	24556652916729900	12.51	0.48	0.49	0.47
38	2455660.56	9.95	0.49	0.50	0.48	123	24556652922283700	12.52	0.48	0.49	0.47
39	2455660.561	9.98	0.48	0.49	0.47	124	24556652927876200	12.49	0.47	0.48	0.46
40	2455660.563	9.97	0.46	0.47	0.45	125	24556652933441000	12.45	0.45	0.46	0.44
41	2455660.565	9.85	0.49	0.50	0.48	126	24556652939026600	12.46	0.48	0.49	0.47
42	2455660.566	9.98	0.48	0.49	0.47	127	24556652945395700	12.53	0.47	0.48	0.46
43	2455660.569	9.86	0.49	0.50	0.48	128	24556652951765900	12.52	0.48	0.49	0.47
44	2455660.571	9.82	0.48	0.49	0.47	129	24556652957309900	12.55	0.47	0.48	0.46
45	2455660.573	9.80	0.48	0.49	0.47	130	24556652962858400	12.42	0.47	0.48	0.46
46	2455660.574	9.82	0.48	0.49	0.47	131	24556652968479900	12.47	0.47	0.48	0.46
47	2455660.576	9.73	0.49	0.50	0.48	132	24556652975325400	12.51	0.48	0.49	0.47
48	2455660.578	9.71	0.49	0.50	0.48	133	24556652980906300	12.36	0.48	0.49	0.47
49	2455660.579	9.71	0.48	0.49	0.47	134	24556652986439800	12.45	0.47	0.48	0.46
50	2455660.581	9.67	0.49	0.50	0.48	135	24556652992031900	12.47	0.48	0.49	0.47
51	2455660.583	9.68	0.48	0.49	0.47	136	24556652997590900	12.46	0.47	0.48	0.46
52	2455660.586	9.62	0.48	0.49	0.47	137	24556653003166000	12.39	0.47	0.48	0.46
53	2455660.587	9.53	0.49	0.50	0.48	138	24556653008749300	12.44	0.48	0.49	0.47
54	2455660.589	9.60	0.49	0.50	0.48	139	24556653015610900	12.43	0.48	0.49	0.47
55	2455660.591	9.52	0.49	0.50	0.48	140	24556653021225500	12.48	0.48	0.49	0.47
56	2455660.592	9.52	0.49	0.50	0.48	141	24556653026760500	12.42	0.48	0.49	0.47
57	2455660.594	9.59	0.47	0.48	0.46	142	24556653032334400	12.45	0.46	0.47	0.45
58	2455660.596	9.42	0.48	0.49	0.47	143	24556653037858600	12.46	0.47	0.48	0.46
59	2455660.597	9.43	0.49	0.50	0.48	144	24556653043565900	12.42	0.48	0.49	0.47
60	2455660.599	9.34	0.49	0.50	0.48	145	24556653049246500	12.52	0.48	0.49	0.47
61	2455660.602	9.36	0.48	0.49	0.47	146	24556653054949100	12.50	0.47	0.48	0.46
62	2455660.604	9.35	0.49	0.50	0.48	147	24556653060529000	12.37	0.48	0.49	0.47
63	2455660.605	9.32	0.48	0.49	0.47	148	24556653066167900	12.46	0.47	0.48	0.46
64	2455660.607	9.30	0.49	0.50	0.48	149	24556653071746600	12.42	0.48	0.49	0.47
65	2455660.609	9.25	0.49	0.50	0.48	150	24556653077587100	12.38	0.48	0.49	0.47
66	2455660.61	9.34	0.47	0.48	0.46	151	24556653084363100	12.46	0.46	0.47	0.45
67	2455660.612	9.26	0.48	0.49	0.47	152	24556653090021700	12.43	0.47	0.48	0.46
68	2455660.613	9.30	0.48	0.49	0.47	153	24556653095689000	12.52	0.47	0.48	0.46
69	2455660.615	9.10	0.49	0.50	0.48	154	24556653101235100	12.42	0.48	0.49	0.47
70	2455660.618	9.09	0.49	0.50	0.48	155	24556653106823000	12.42	0.48	0.49	0.47
71	2455660.62	9.15	0.49	0.50	0.48	156	24556653112372600	12.54	0.48	0.49	0.47
72	2455660.622	9.12	0.48	0.49	0.47	157	24556653118839200	12.55	0.47	0.48	0.46
73	2455660.623	9.01	0.49	0.50	0.48	158	24556653124393500	12.42	0.48	0.49	0.47
74	2455660.625	9.09	0.47	0.48	0.46	159	24556653130005600	12.50	0.46	0.47	0.45
75	2455660.626	9.02	0.49	0.50	0.48	160	24556653135615800	12.41	0.48	0.49	0.47
76	2455660.628	8.95	0.49	0.50	0.48	161	24556653141175900	12.41	0.48	0.49	0.47
77	2455660.63	8.88	0.49	0.50	0.48	162	24556653146784700	12.45	0.48	0.49	0.47
78	2455660.631	8.94	0.49	0.50	0.48	163	24556653153127100	12.51	0.48	0.49	0.47
79	2455660.635	8.79	0.47	0.48	0.46	164	24556653158642000	12.45	0.46	0.47	0.45
80	2455660.636	8.88	0.47	0.48	0.46	165	24556653164220700	12.45	0.46	0.47	0.45
81	2455660.638	8.76	0.49	0.50	0.48	166	24556653169756100	12.44	0.48	0.49	0.47
82	2455660.639	8.88	0.48	0.49	0.47	167	24556653176467200	12.49	0.47	0.48	0.46
83	2455660.641	8.75	0.49	0.50	0.48	168	24556653182293800	12.44	0.48	0.49	0.47
84	2455660.643	8.72	0.50	0.51	0.49	169	24556653187862000	12.46	0.49	0.50	0.48
85	2455660.644	8.64	0.49	0.50	0.48	170	24556653194300600	12.43	0.48	0.49	0.47

Table 4: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
176	24556653230358900	12.44	0.49	0.50	0.48	238	24556653584868100	12.76	0.47	0.48	0.46
177	24556653235921600	12.53	0.49	0.50	0.48	239	24556653591496900	12.83	0.48	0.49	0.47
178	24556653241480500	12.51	0.49	0.50	0.48	240	24556653597089400	12.81	0.50	0.51	0.49
179	24556653247022100	12.39	0.49	0.50	0.48	241	24556653602708600	12.82	0.48	0.49	0.47
180	24556653253416600	12.48	0.48	0.49	0.47	242	24556653608257100	12.83	0.46	0.47	0.45
181	24556653258990600	12.60	0.48	0.49	0.47	243	24556653613801000	12.90	0.49	0.50	0.48
182	24556653265331900	12.41	0.49	0.50	0.48	244	24556653619799300	12.73	0.51	0.52	0.50
183	24556653270983900	12.55	0.48	0.49	0.47	245	24556653625865900	12.81	0.49	0.50	0.48
184	24556653277492100	12.44	0.47	0.48	0.46	246	24556653632653400	12.84	0.48	0.49	0.47
185	24556653283389400	12.56	0.49	0.50	0.48	247	24556653638242500	12.84	0.48	0.49	0.47
186	24556653288936800	12.55	0.48	0.49	0.47	248	24556653643824600	12.88	0.47	0.48	0.46
187	24556653294509700	12.53	0.48	0.49	0.47	249	24556653650192500	12.86	0.47	0.48	0.46
188	24556653300065100	12.58	0.49	0.50	0.48	250	24556653655789300	12.81	0.48	0.49	0.47
189	24556653306350500	12.48	0.49	0.50	0.48	251	24556653661388800	12.93	0.48	0.49	0.47
190	24556653312276800	12.47	0.49	0.50	0.48	252	24556653666937300	12.98	0.48	0.49	0.47
191	24556653318013000	12.44	0.48	0.49	0.47	253	24556653672509000	12.89	0.47	0.48	0.46
192	24556653323786400	12.53	0.47	0.48	0.46	254	24556653678085300	12.95	0.46	0.47	0.45
193	24556653329396400	12.53	0.48	0.49	0.47	255	24556653684843800	12.90	0.47	0.48	0.46
194	24556653335064200	12.49	0.48	0.49	0.47	256	24556653690757000	12.88	0.47	0.48	0.46
195	24556653340705400	12.60	0.49	0.50	0.48	257	24556653696324000	12.96	0.48	0.49	0.47
196	24556653346295600	12.53	0.49	0.50	0.48	258	24556653701909700	12.95	0.48	0.49	0.47
197	24556653351937900	12.49	0.49	0.50	0.48	259	24556653708747100	12.92	0.48	0.49	0.47
198	24556653357535100	12.61	0.49	0.50	0.48	260	24556653714379000	12.94	0.48	0.49	0.47
199	24556653363146200	12.58	0.48	0.49	0.47	261	24556653720559100	12.99	0.47	0.48	0.46
200	24556653368735200	12.55	0.47	0.48	0.46	262	24556653726135900	12.92	0.46	0.47	0.45
201	24556653374371600	12.64	0.48	0.49	0.47	263	24556653731718000	13.02	0.47	0.48	0.46
202	24556653380109000	12.51	0.49	0.50	0.48	264	24556653737332600	13.03	0.48	0.49	0.47
203	24556653385703900	12.55	0.49	0.50	0.48	265	24556653742920400	12.98	0.48	0.49	0.47
204	24556653391315000	12.56	0.49	0.50	0.48	266	24556653748538500	12.97	0.48	0.49	0.47
205	24556653396893600	12.60	0.48	0.49	0.47	267	24556653755350400	13.01	0.47	0.48	0.46
206	24556653402503500	12.58	0.48	0.49	0.47	268	24556653761081000	13.08	0.47	0.48	0.46
207	24556653408062500	12.61	0.49	0.50	0.48	269	24556653766697900	13.03	0.48	0.49	0.47
208	24556653413709200	12.63	0.49	0.50	0.48	270	24556653772288000	12.98	0.48	0.49	0.47
209	24556653419267000	12.57	0.48	0.49	0.47	271	24556653779131200	13.06	0.47	0.48	0.46
210	24556653424843200	12.55	0.46	0.47	0.45	272	24556653784667000	13.08	0.45	0.46	0.44
211	24556653430426600	12.66	0.49	0.50	0.48	273	24556653791528200	13.00	0.48	0.49	0.47
212	24556653436049300	12.65	0.48	0.49	0.47	274	24556653797223900	13.05	0.47	0.48	0.46
213	24556653441608200	12.64	0.49	0.50	0.48	275	24556653802901100	13.12	0.48	0.49	0.47
214	24556653447313700	12.65	0.48	0.49	0.47	276	24556653808483200	12.99	0.47	0.48	0.46
215	24556653452891200	12.58	0.48	0.49	0.47	277	24556653814052500	13.09	0.47	0.48	0.46
216	24556653458462800	12.62	0.48	0.49	0.47	278	24556653819624100	13.11	0.47	0.48	0.46
217	24556653464128400	12.67	0.49	0.50	0.48	279	24556653825209800	13.03	0.48	0.49	0.47
218	24556653469690800	12.64	0.49	0.50	0.48	280	24556653830750200	13.11	0.48	0.49	0.47
219	24556653475287900	12.63	0.48	0.49	0.47	281	24556653836327600	13.10	0.47	0.48	0.46
220	24556653480821600	12.71	0.49	0.50	0.48	282	24556653841873800	13.10	0.48	0.49	0.47
221	24556653486403700	12.65	0.48	0.49	0.47	283	24556653847442000	13.09	0.47	0.48	0.46
222	24556653492037900	12.69	0.48	0.49	0.47	284	24556653853038000	13.10	0.47	0.48	0.46
223	24556653498563500	12.68	0.49	0.50	0.48	285	24556653858688500	13.11	0.48	0.49	0.47
224	24556653504101600	12.78	0.49	0.50	0.48	286	24556653865023200	13.18	0.48	0.49	0.47
225	24556653509681400	12.69	0.49	0.50	0.48	287	24556653870615700	13.16	0.48	0.49	0.47
226	24556653515192000	12.64	0.49	0.50	0.48	288	24556653876204800	13.18	0.48	0.49	0.47
227	24556653520793800	12.68	0.47	0.48	0.46	289	24556653881785700	13.17	0.46	0.47	0.45
228	24556653527356400	12.71	0.48	0.49	0.47	290	24556653887352700	13.16	0.47	0.48	0.46
229	24556653532952500	12.71	0.49	0.50	0.48	291	24556653892999700	13.18	0.48	0.49	0.47
230	24556653538556700	12.77	0.49	0.50	0.48	292	24556653899714800	13.14	0.48	0.49	0.47
231	24556653544192100	12.68	0.48	0.49	0.47	293	24556653905302600	13.23	0.47	0.48	0.46
232	24556653549781000	12.68	0.49	0.50	0.48	294	24556653910853400	13.14	0.48	0.49	0.47

Table 5: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
295	24556653916570000	13.20	0.47	0.48	0.46	357	24556654276419000	13.55	0.46	0.47	0.45
296	24556653922152100	13.07	0.48	0.49	0.47	358	24556654281996900	13.60	0.47	0.48	0.46
297	24556653927842000	13.16	0.48	0.49	0.47	359	24556654288781000	13.54	0.47	0.48	0.46
298	24556653933438700	13.21	0.49	0.50	0.48	360	24556654294336400	13.48	0.48	0.49	0.47
299	24556653939086900	13.19	0.49	0.50	0.48	361	24556654299909200	13.53	0.48	0.49	0.47
300	24556653944666700	13.19	0.49	0.50	0.48	362	24556654305528400	13.46	0.48	0.49	0.47
301	24556653950225600	13.16	0.48	0.49	0.47	363	24556654311118700	13.48	0.47	0.48	0.46
302	24556653955762400	13.24	0.49	0.50	0.48	364	24556654316736200	13.57	0.48	0.49	0.47
303	24556653961280900	13.17	0.47	0.48	0.46	365	24556654322322900	13.52	0.46	0.47	0.45
304	24556653966839500	13.28	0.49	0.50	0.48	366	24556654329087200	13.52	0.48	0.49	0.47
305	24556653972389200	13.24	0.49	0.50	0.48	367	24556654334729600	13.49	0.48	0.49	0.47
306	24556653977952700	13.22	0.49	0.50	0.48	368	24556654340275800	13.56	0.48	0.49	0.47
307	24556653984368100	13.16	0.49	0.50	0.48	369	24556654345860300	13.73	0.48	0.49	0.47
308	24556653989910800	13.26	0.47	0.48	0.46	370	24556654351722500	13.65	0.46	0.47	0.45
309	24556653996635800	13.23	0.47	0.48	0.46	371	24556654357265100	13.61	0.46	0.47	0.45
310	24556654002184900	13.32	0.49	0.50	0.48	372	24556654362915700	13.58	0.48	0.49	0.47
311	24556654007765800	13.33	0.48	0.49	0.47	373	24556654368481500	13.56	0.47	0.48	0.46
312	24556654013345600	13.32	0.49	0.50	0.48	374	24556654375245900	13.61	0.48	0.49	0.47
313	24556654019088800	13.32	0.50	0.51	0.49	375	24556654380841800	13.59	0.49	0.50	0.48
314	24556654024665100	13.28	0.49	0.50	0.48	376	24556654386449500	13.53	0.48	0.49	0.47
315	24556654030248300	13.36	0.50	0.51	0.49	377	24556654392049000	13.66	0.49	0.50	0.48
316	24556654035810900	13.33	0.49	0.50	0.48	378	24556654398865600	13.67	0.48	0.49	0.47
317	24556654041374500	13.30	0.50	0.51	0.49	379	24556654405714500	13.55	0.49	0.50	0.48
318	24556654046932200	13.28	0.49	0.50	0.48	380	24556654411261900	13.65	0.48	0.49	0.47
319	24556654053666400	13.33	0.50	0.51	0.49	381	24556654416796400	13.66	0.49	0.50	0.48
320	24556654060420300	13.34	0.49	0.50	0.48	382	24556654422373600	13.67	0.48	0.49	0.47
321	24556654066014100	13.41	0.50	0.51	0.49	383	24556654427924400	13.63	0.49	0.50	0.48
322	24556654071556500	13.29	0.49	0.50	0.48	384	24556654434249400	13.60	0.48	0.49	0.47
323	24556654077128200	13.28	0.50	0.51	0.49	385	24556654439857000	13.69	0.49	0.50	0.48
324	24556654083973700	13.32	0.49	0.50	0.48	386	24556654445417100	13.64	0.48	0.49	0.47
325	24556654089591700	13.38	0.50	0.51	0.49	387	24556654450972500	13.71	0.49	0.50	0.48
326	24556654095137900	13.32	0.49	0.50	0.48	388	24556654456745700	13.76	0.48	0.49	0.47
327	24556654100738500	13.32	0.50	0.51	0.49	389	24556654462462200	13.65	0.49	0.50	0.48
328	24556654106304700	13.28	0.49	0.50	0.48	390	24556654467996800	13.72	0.48	0.49	0.47
329	24556654111875200	13.39	0.50	0.51	0.49	391	24556654473573100	13.74	0.49	0.50	0.48
330	24556654117494400	13.37	0.49	0.50	0.48	392	24556654479322100	13.64	0.48	0.49	0.47
331	24556654123396400	13.30	0.50	0.51	0.49	393	24556654484896100	13.68	0.49	0.50	0.48
332	24556654128947200	13.38	0.49	0.50	0.48	394	24556654490481500	13.62	0.48	0.49	0.47
333	24556654134508400	13.35	0.50	0.51	0.49	395	24556654496053200	13.70	0.49	0.50	0.48
334	24556654140059200	13.39	0.49	0.50	0.48	396	24556654501990000	13.68	0.48	0.49	0.47
335	24556654145611200	13.42	0.50	0.51	0.49	397	24556654507574400	13.63	0.49	0.50	0.48
336	24556654151179300	13.41	0.49	0.50	0.48	398	24556654513155400	13.72	0.48	0.49	0.47
337	24556654156839200	13.56	0.50	0.51	0.49	399	24556654518706200	13.71	0.49	0.50	0.48
338	24556654162406200	13.58	0.49	0.50	0.48	400	24556654524290600	13.69	0.48	0.49	0.47
339	24556654167942000	13.49	0.50	0.51	0.49	401	24556654529855400	13.64	0.49	0.50	0.48
340	24556654173833600	13.42	0.49	0.50	0.48	402	24556654536454000	13.76	0.48	0.49	0.47
341	24556654180101900	13.47	0.50	0.51	0.49	403	24556654542032600	13.79	0.49	0.50	0.48
342	24556654185717700	13.48	0.49	0.50	0.48	404	24556654547604200	13.69	0.48	0.49	0.47
343	24556654191300900	13.47	0.50	0.51	0.49	405	24556654553151600	13.77	0.49	0.50	0.48
344	24556654196834300	13.48	0.49	0.50	0.48	406	24556654558792700	13.68	0.48	0.49	0.47
345	24556654202421000	13.43	0.50	0.51	0.49	407	24556654564362100	13.64	0.49	0.50	0.48
346	24556654207991500	13.45	0.49	0.50	0.48	408	24556654569905900	13.76	0.48	0.49	0.47
347	24556654213553700	13.40	0.50	0.51	0.49	409	24556654575481100	13.80	0.49	0.50	0.48
348	24556654219152000	13.49	0.49	0.50	0.48	410	24556654581052700	13.76	0.48	0.49	0.47
349	24556654224803700	13.47	0.50	0.51	0.49	411	24556654587725500	13.77	0.49	0.50	0.48
350	24556654230366000	13.51	0.49	0.50	0.48	412	24556654593281900	13.79	0.48	0.49	0.47
351	24556654235898300	13.56	0.50	0.51	0.49	413	24556654598855900	13.73	0.49	0.50	0.48
352	24556654241861800	13.46	0.49	0.50	0.48	414	24556654604450800	13.81	0.48	0.49	0.47
353	24556654247415600	13.47	0.50	0.51	0.49	415	24556654610020100	13.78	0.49	0.50	0.48
354	24556654252981400	13.45	0.49	0.50	0.48	416	24556654615624300	13.81	0.48	0.49	0.47
355	24556654258586800	13.59	0.50	0.51	0.49	417	24556654621248100	13.76	0.49	0.50	0.48
356	24556654269681400	13.55	0.49	0.50	0.48	418	24556654626793400	13.76	0.48	0.49	0.47

Table 6: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
419	24556654632343000	13.73	0.47	0.48	0.46	481	24556654984791000	13.73	0.46	0.47	0.45
420	24556654637922800	13.81	0.48	0.49	0.47	482	24556654990333600	13.85	0.47	0.48	0.46
421	24556654643471200	13.87	0.48	0.49	0.47	483	24556654995913500	13.81	0.47	0.48	0.46
422	24556654649026700	13.82	0.49	0.50	0.48	484	24556655001519900	13.85	0.48	0.49	0.47
423	24556654654640100	13.81	0.49	0.50	0.48	485	24556655008151500	13.84	0.48	0.49	0.47
424	24556654660185100	13.77	0.49	0.50	0.48	486	24556655014564600	13.83	0.48	0.49	0.47
425	24556654666819600	13.77	0.48	0.49	0.47	487	24556655020131700	13.79	0.47	0.48	0.46
426	24556654672834000	13.75	0.49	0.50	0.48	488	24556655025658200	13.87	0.48	0.49	0.47
427	24556654678405700	13.77	0.47	0.48	0.46	489	24556655031217100	13.82	0.46	0.47	0.45
428	24556654684818800	13.79	0.49	0.50	0.48	490	24556655036801500	13.82	0.48	0.49	0.47
429	24556654690413700	13.79	0.49	0.50	0.48	491	24556655042393900	13.86	0.48	0.49	0.47
430	24556654695963000	13.72	0.49	0.50	0.48	492	24556655048014100	13.85	0.48	0.49	0.47
431	24556654702558200	13.78	0.49	0.50	0.48	493	24556655053573000	13.82	0.48	0.49	0.47
432	24556654708134400	13.82	0.47	0.48	0.46	494	24556655060135600	13.82	0.46	0.47	0.45
433	24556654713713000	13.76	0.47	0.48	0.46	495	24556655065714300	13.85	0.46	0.47	0.45
434	24556654719255700	13.87	0.49	0.50	0.48	496	24556655071302200	13.79	0.48	0.49	0.47
435	24556654724847200	13.81	0.48	0.49	0.47	497	24556655076851800	13.88	0.47	0.48	0.46
436	24556654730451100	13.74	0.49	0.50	0.48	498	24556655083221000	13.84	0.48	0.49	0.47
437	24556654736065700	13.79	0.50	0.51	0.49	499	24556655088762600	13.82	0.49	0.50	0.48
438	24556654741618800	13.88	0.49	0.50	0.48	500	24556655094329600	13.82	0.48	0.49	0.47
439	24556654747193900	13.87	0.50	0.51	0.49	501	24556655099916400	13.80	0.49	0.50	0.48
440	24556654752774800	13.81	0.49	0.50	0.48	502	24556655105461400	13.84	0.48	0.49	0.47
441	24556654758368600	13.82	0.50	0.51	0.49	503	24556655111015700	13.86	0.49	0.50	0.48
442	24556654763956400	13.82	0.49	0.50	0.48	504	24556655116674700	13.81	0.48	0.49	0.47
443	24556654769533100	13.80	0.50	0.51	0.49	505	24556655122293900	13.86	0.49	0.50	0.48
444	24556654775116300	13.86	0.49	0.50	0.48	506	24556655127811200	13.67	0.48	0.49	0.47
445	24556654780739000	13.79	0.50	0.51	0.49	507	24556655133409400	13.76	0.49	0.50	0.48
446	24556654786297900	13.80	0.49	0.50	0.48	508	24556655140012700	13.75	0.48	0.49	0.47
447	24556654791912500	13.80	0.50	0.51	0.49	509	24556655145583200	13.84	0.49	0.50	0.48
448	24556654797498000	13.85	0.49	0.50	0.48	510	24556655151216600	13.86	0.48	0.49	0.47
449	24556654803051900	13.74	0.50	0.51	0.49	511	24556655156797500	13.84	0.49	0.50	0.48
450	24556654808685000	13.84	0.49	0.50	0.48	512	24556655162348300	13.86	0.48	0.49	0.47
451	24556654814245100	13.90	0.50	0.51	0.49	513	24556655167956000	13.82	0.49	0.50	0.48
452	24556654819811100	13.83	0.49	0.50	0.48	514	24556655173516000	13.85	0.48	0.49	0.47
453	24556654825400100	13.80	0.50	0.51	0.49	515	24556655179048300	13.79	0.49	0.50	0.48
454	24556654830969400	13.84	0.49	0.50	0.48	516	24556655185377600	13.87	0.48	0.49	0.47
455	24556654836587800	13.82	0.50	0.51	0.49	517	24556655190964300	13.80	0.49	0.50	0.48
456	24556654842138600	13.74	0.49	0.50	0.48	518	24556655196519700	13.82	0.48	0.49	0.47
457	24556654847675500	13.88	0.50	0.51	0.49	519	24556655202264100	13.77	0.49	0.50	0.48
458	24556654853241400	13.82	0.49	0.50	0.48	520	24556655207833500	13.74	0.48	0.49	0.47
459	24556654858810700	13.85	0.50	0.51	0.49	521	24556655213451500	13.82	0.49	0.50	0.48
460	24556654864404500	13.87	0.49	0.50	0.48	522	24556655218974600	13.74	0.48	0.49	0.47
461	24556654869982100	13.80	0.50	0.51	0.49	523	24556655224627400	13.84	0.49	0.50	0.48
462	24556654876221400	13.91	0.49	0.50	0.48	524	24556655230179300	13.78	0.48	0.49	0.47
463	24556654881786100	13.89	0.50	0.51	0.49	525	24556655235749800	13.79	0.49	0.50	0.48
464	24556654887340300	13.81	0.49	0.50	0.48	526	24556655241311100	13.83	0.48	0.49	0.47
465	24556654892920200	13.85	0.50	0.51	0.49	527	24556655247381200	13.72	0.49	0.50	0.48
466	24556654898476800	13.80	0.49	0.50	0.48	528	24556655253883500	13.79	0.48	0.49	0.47
467	24556654904072400	13.78	0.50	0.51	0.49	529	24556655259430900	13.76	0.49	0.50	0.48
468	24556654909649800	13.85	0.49	0.50	0.48	530	24556655265011900	13.80	0.48	0.49	0.47
469	24556654915257400	13.93	0.50	0.51	0.49	531	24556655270527800	13.74	0.49	0.50	0.48
470	24556654922125000	13.84	0.49	0.50	0.48	532	24556655276099500	13.65	0.48	0.49	0.47
471	24556654928473200	13.85	0.50	0.51	0.49	533	24556655281650300	13.71	0.49	0.50	0.48
472	24556654934138700	13.76	0.49	0.50	0.48	534	24556655288435400	13.80	0.48	0.49	0.47
473	24556654939656700	13.87	0.50	0.51	0.49	535	24556655294068500	13.67	0.49	0.50	0.48
474	24556654945711600	13.82	0.49	0.50	0.48	536	24556655299629700	13.72	0.48	0.49	0.47
475	24556654951339000	13.85	0.50	0.51	0.49	537	24556655305211800	13.75	0.49	0.50	0.48
476	24556654956944300	13.86	0.49	0.50	0.48	538	24556655310813600	13.69	0.48	0.49	0.47
477	24556654962485700	13.83	0.50	0.51	0.49	539	24556655317195400	13.71	0.49	0.50	0.48
478	24556654968060900	13.80	0.49	0.50	0.48	540	24556655322776300	13.78	0.48	0.49	0.47
479	24556654973644200	13.81	0.50	0.51	0.49	541	24556655328402500	13.77	0.49	0.50	0.48
480	24556654979254100	13.88	0.49	0.50	0.48	542	24556655333966000	13.67	0.48	0.49	0.47

Table 7: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
543	24556655339472800	13.70	0.47	0.48	0.46	605	24556655718554200	13.47	0.46	0.47	0.45
544	24556655344773200	13.69	0.48	0.49	0.47	606	24556655724989400	13.46	0.47	0.48	0.46
545	24556655350096800	13.69	0.48	0.49	0.47	607	24556655730584300	13.48	0.47	0.48	0.46
546	24556655355420400	13.76	0.49	0.50	0.48	608	24556655737295300	13.30	0.48	0.49	0.47
547	24556655360746200	13.59	0.49	0.50	0.48	609	24556655742928700	13.38	0.48	0.49	0.47
548	24556655366071000	13.81	0.49	0.50	0.48	610	24556655748478300	13.40	0.48	0.49	0.47
549	24556655394798600	13.79	0.48	0.49	0.47	611	24556655754055900	13.35	0.47	0.48	0.46
550	24556655400422400	13.65	0.49	0.50	0.48	612	24556655759599700	13.27	0.48	0.49	0.47
551	24556655406125100	13.70	0.47	0.48	0.46	613	24556655765186400	13.39	0.46	0.47	0.45
552	24556655411687400	13.72	0.49	0.50	0.48	614	24556655770834600	13.41	0.48	0.49	0.47
553	24556655417224400	13.72	0.49	0.50	0.48	615	24556655776589200	13.30	0.48	0.49	0.47
554	24556655422827300	13.63	0.49	0.50	0.48	616	24556655782192100	13.39	0.48	0.49	0.47
555	24556655428430200	13.65	0.49	0.50	0.48	617	24556655787773100	13.42	0.48	0.49	0.47
556	24556655434022600	13.71	0.47	0.48	0.46	618	24556655793653100	13.22	0.46	0.47	0.45
557	24556655439575800	13.70	0.47	0.48	0.46	619	24556655799247900	13.30	0.46	0.47	0.45
558	24556655445914800	13.68	0.49	0.50	0.48	620	24556655804825400	13.31	0.48	0.49	0.47
559	24556655451492200	13.67	0.48	0.49	0.47	621	24556655810727100	13.22	0.47	0.48	0.46
560	24556655457121800	13.64	0.49	0.50	0.48	622	24556655816297600	13.20	0.48	0.49	0.47
561	24556655463781200	13.69	0.50	0.51	0.49	623	24556655823115300	13.34	0.49	0.50	0.48
562	24556655469328500	13.71	0.49	0.50	0.48	624	24556655828760000	13.25	0.48	0.49	0.47
563	24556655474877000	13.83	0.50	0.51	0.49	625	24556655834323600	13.27	0.49	0.50	0.48
564	24556655480785900	13.69	0.49	0.50	0.48	626	24556655840051700	13.28	0.48	0.49	0.47
565	24556655486333300	13.63	0.50	0.51	0.49	627	24556655845792800	13.26	0.49	0.50	0.48
566	24556655493006100	13.65	0.49	0.50	0.48	628	24556655851369000	13.25	0.48	0.49	0.47
567	24556655499079600	13.58	0.50	0.51	0.49	629	24556655856953500	13.28	0.49	0.50	0.48
568	24556655504702300	13.57	0.49	0.50	0.48	630	24556655863403800	13.16	0.48	0.49	0.47
569	24556655510234600	13.60	0.50	0.51	0.49	631	24556655868992800	13.23	0.49	0.50	0.48
570	24556655515806200	13.65	0.49	0.50	0.48	632	24556655874579600	13.27	0.48	0.49	0.47
571	24556655521403300	13.54	0.50	0.51	0.49	633	24556655880153500	13.25	0.49	0.50	0.48
572	24556655526951800	13.62	0.49	0.50	0.48	634	24556655885758900	13.17	0.48	0.49	0.47
573	24556655533720300	13.58	0.50	0.51	0.49	635	24556655891525300	13.29	0.49	0.50	0.48
574	24556655539322200	13.58	0.49	0.50	0.48	636	24556655897167700	13.20	0.48	0.49	0.47
575	24556655544896100	13.48	0.50	0.51	0.49	637	24556655902473900	13.16	0.49	0.50	0.48
576	24556655550480600	13.60	0.49	0.50	0.48	638	24556655907810300	13.15	0.48	0.49	0.47
577	24556655556040700	13.57	0.50	0.51	0.49	639	24556655913161100	13.29	0.49	0.50	0.48
578	24556655562264900	13.53	0.49	0.50	0.48	640	24556655918548400	13.16	0.48	0.49	0.47
579	24556655568498700	13.54	0.50	0.51	0.49	641	24556655923927700	13.24	0.49	0.50	0.48
580	24556655574101700	13.51	0.49	0.50	0.48	642	24556655930281700	13.27	0.48	0.49	0.47
581	24556655579652500	13.57	0.50	0.51	0.49	643	24556655935627400	13.12	0.49	0.50	0.48
582	24556655586073800	13.49	0.49	0.50	0.48	644	24556655940979900	13.25	0.48	0.49	0.47
583	24556655591691900	13.40	0.50	0.51	0.49	645	24556655946298900	13.15	0.49	0.50	0.48
584	24556655597306300	13.53	0.49	0.50	0.48	646	24556655951630200	13.24	0.48	0.49	0.47
585	24556655603040100	13.53	0.50	0.51	0.49	647	2455687.385	11.22	12.05	12.57	12.97
586	24556655608659200	13.53	0.49	0.50	0.48	648	2455687.387	11.21	12.04	12.57	12.99
587	24556655615492000	13.50	0.50	0.51	0.49	649	2455687.389	11.21	12.04	12.58	12.99
588	24556655621039300	13.43	0.49	0.50	0.48	650	2455687.39	11.21	12.05	12.56	12.99
589	24556655627471000	13.39	0.50	0.51	0.49	651	2455687.392	11.21	12.05	12.57	12.98
590	24556655633067100	13.43	0.49	0.50	0.48	652	2455687.394	11.20	12.04	12.57	12.99
591	24556655638603700	13.48	0.50	0.51	0.49	653	2455687.395	11.19	12.04	12.59	12.98
592	24556655644191500	13.40	0.49	0.50	0.48	654	2455687.397	11.19	12.05	12.58	12.97
593	24556655649712200	13.42	0.50	0.51	0.49	655	2455687.398	11.18	12.05	12.56	12.98
594	24556655656432500	13.54	0.49	0.50	0.48	656	2455687.402	11.18	12.06	12.56	12.97
595	24556655662007700	13.46	0.50	0.51	0.49	657	2455687.403	11.17	12.05	12.57	12.96
596	24556655668153100	13.43	0.49	0.50	0.48	658	2455687.405	11.17	12.05	12.56	12.99
597	24556655673729000	13.43	0.50	0.51	0.49	659	2455687.406	11.17	12.05	12.57	12.97
598	24556655679334300	13.51	0.49	0.50	0.48	660	2455687.408	11.16	12.05	12.56	12.99
599	24556655684878200	13.47	0.50	0.51	0.49	661	2455687.41	11.15	12.05	12.57	12.97
600	24556655690464900	13.41	0.49	0.50	0.48	662	2455687.411	11.14	12.05	12.57	12.98
601	24556655696049400	13.37	0.50	0.51	0.49	663	2455687.413	11.14	12.05	12.58	12.96
602	24556655701598900	13.44	0.49	0.50	0.48	664	2455687.415	11.15	12.04	12.58	12.97
603	24556655707398200	13.46	0.50	0.51	0.49	665	2455687.418	11.13	12.05	12.57	12.98
604	24556655713002300	13.36	0.49	0.50	0.48	666	2455687.419	11.14	12.04	12.59	12.97

Table 8: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
667	2455687.421	11.12	12.05	12.57	12.98	729	2455687.533	10.40	12.04	12.58	12.98
668	2455687.423	11.11	12.04	12.58	12.98	730	2455687.534	10.41	12.04	12.57	13.00
669	2455687.424	11.12	12.04	12.58	12.97	731	2455687.536	10.41	12.05	12.58	12.97
670	2455687.426	11.12	12.05	12.57	12.98	732	2455687.538	10.41	12.06	12.58	12.95
671	2455687.428	11.11	12.05	12.56	12.99	733	2455687.539	10.44	12.05	12.57	12.97
672	2455687.429	11.09	12.05	12.58	12.97	734	2455687.541	10.44	12.04	12.58	12.98
673	2455687.431	11.09	12.05	12.56	12.99	735	2455687.543	10.45	12.05	12.57	12.98
674	2455687.434	11.08	12.05	12.57	12.97	736	2455687.544	10.45	12.05	12.56	12.98
675	2455687.436	11.06	12.05	12.57	12.98	737	2455687.547	10.47	12.05	12.56	12.98
676	2455687.437	11.04	12.05	12.58	12.97	738	2455687.549	10.48	12.05	12.57	12.99
677	2455687.439	11.02	12.05	12.56	12.99	739	2455687.551	10.49	12.05	12.57	12.98
678	2455687.44	11.01	12.05	12.57	12.98	740	2455687.552	10.49	12.05	12.59	12.96
679	2455687.442	11.00	12.05	12.57	12.98	741	2455687.554	10.49	12.05	12.58	12.97
680	2455687.444	10.97	12.05	12.58	12.97	742	2455687.556	10.51	12.05	12.58	12.96
681	2455687.445	10.95	12.04	12.58	12.98	743	2455687.557	10.52	12.04	12.57	13.00
682	2455687.447	10.93	12.04	12.58	12.99	744	2455687.559	10.52	12.04	12.59	12.96
683	2455687.45	10.87	12.04	12.58	12.97	745	2455687.56	10.52	12.04	12.58	12.97
684	2455687.452	10.83	12.05	12.58	12.98	746	2455687.564	10.54	12.06	12.55	12.98
685	2455687.453	10.81	12.04	12.58	12.99	747	2455687.565	10.56	12.04	12.58	12.99
686	2455687.455	10.76	12.05	12.56	12.99	748	2455687.567	10.55	12.04	12.58	12.99
687	2455687.457	10.72	12.04	12.58	12.98	749	2455687.568	10.56	12.05	12.58	12.95
688	2455687.458	10.69	12.05	12.57	12.98	750	2455687.57	10.57	12.06	12.56	12.97
689	2455687.46	10.63	12.04	12.58	12.99	751	2455687.572	10.60	12.05	12.59	12.94
690	2455687.462	10.59	12.05	12.57	12.99	752	2455687.573	10.60	12.04	12.58	12.98
691	2455687.463	10.52	12.04	12.58	12.98	753	2455687.575	10.59	12.05	12.56	12.98
692	2455687.466	10.42	12.05	12.57	12.99	754	2455687.577	10.59	12.04	12.58	12.98
693	2455687.468	10.39	12.05	12.56	12.99	755	2455687.58	10.61	12.03	12.60	12.98
694	2455687.47	10.35	12.05	12.57	12.97	756	2455687.581	10.62	12.04	12.59	12.96
695	2455687.471	10.31	12.04	12.57	12.98	757	2455687.583	10.63	12.05	12.57	12.98
696	2455687.473	10.27	12.06	12.56	12.96	758	2455687.585	10.64	12.04	12.59	12.98
697	2455687.474	10.23	12.04	12.58	12.98	759	2455687.586	10.65	12.04	12.59	12.95
698	2455687.476	10.22	12.05	12.56	12.97	760	2455687.588	10.65	12.04	12.57	12.99
699	2455687.478	10.20	12.04	12.58	12.98	761	2455687.59	10.67	12.06	12.56	12.96
700	2455687.479	10.19	12.05	12.56	12.98	762	2455709.428	10.92	12.04	12.57	12.99
701	2455687.483	10.17	12.04	12.57	13.00	763	2455709.43	10.92	12.04	12.56	13.00
702	2455687.484	10.17	12.04	12.58	12.98	764	2455709.432	10.90	12.04	12.57	13.01
703	2455687.486	10.17	12.05	12.57	12.99	765	2455709.433	10.90	12.04	12.57	13.01
704	2455687.487	10.17	12.04	12.58	12.98	766	2455709.435	10.89	12.04	12.57	13.01
705	2455687.489	10.18	12.04	12.58	12.97	767	2455709.436	10.87	12.05	12.57	12.99
706	2455687.491	10.18	12.04	12.58	12.99	768	2455709.438	10.86	12.05	12.56	12.99
707	2455687.492	10.18	12.04	12.57	12.99	769	2455709.44	10.86	12.04	12.57	13.00
708	2455687.494	10.20	12.05	12.56	12.98	770	2455709.441	10.83	12.04	12.56	13.02
709	2455687.496	10.19	12.04	12.58	12.98	771	2455709.445	10.80	12.04	12.57	13.00
710	2455687.499	10.21	12.04	12.57	13.00	772	2455709.446	10.78	12.04	12.57	13.01
711	2455687.5	10.22	12.05	12.57	12.99	773	2455709.448	10.76	12.05	12.56	13.00
712	2455687.502	10.23	12.06	12.56	12.97	774	2455709.449	10.73	12.04	12.57	13.01
713	2455687.504	10.24	12.04	12.57	12.99	775	2455709.451	10.72	12.04	12.56	13.01
714	2455687.505	10.24	12.05	12.58	12.97	776	2455709.453	10.70	12.04	12.56	13.00
715	2455687.507	10.27	12.05	12.57	12.97	777	2455709.454	10.67	12.03	12.56	13.02
716	2455687.508	10.26	12.05	12.57	12.99	778	2455709.456	10.66	12.04	12.58	12.99
717	2455687.51	10.28	12.05	12.57	12.96	779	2455709.458	10.64	12.04	12.56	13.02
718	2455687.512	10.28	12.04	12.59	12.97	780	2455709.461	10.60	12.04	12.57	13.01
719	2455687.515	10.30	12.04	12.58	12.99	781	2455709.462	10.58	12.04	12.57	13.00
720	2455687.517	10.31	12.05	12.56	12.99	782	2455709.464	10.55	12.03	12.57	13.02
721	2455687.518	10.32	12.05	12.57	12.98	783	2455709.466	10.53	12.03	12.57	13.01
722	2455687.52	10.33	12.04	12.58	12.98	784	2455709.467	10.54	12.04	12.57	13.00
723	2455687.521	10.33	12.04	12.59	12.97	785	2455709.469	10.51	12.04	12.56	13.00
724	2455687.523	10.35	12.06	12.57	12.96	786	2455709.471	10.49	12.04	12.57	13.00
725	2455687.525	10.34	12.04	12.59	12.96	787	2455709.472	10.48	12.04	12.56	13.01
726	2455687.526	10.37	12.05	12.56	12.99	788	2455709.474	10.47	12.04	12.56	13.01
727	2455687.528	10.36	12.04	12.59	12.97	789	2455709.477	10.45	12.04	12.57	13.00
728	2455687.531	10.38	12.05	12.57	12.97	790	2455709.479	10.44	12.05	12.56	12.99

Table 9: V Magnitudo Data for RV UMa and Ref stars

ID	T (JD)	Obj1	Ref1	Ref2	Ref3	ID	T (JD)	Obj1	Ref1	Ref2	Ref3
791	2455709.48	10.43	12.04	12.57	13.00						
792	2455709.482	10.43	12.05	12.56	12.99						
793	2455709.484	10.43	12.04	12.56	13.01						
794	2455709.485	10.42	12.04	12.56	13.02						
795	2455709.487	10.42	12.04	12.56	13.01						
796	2455709.488	10.40	12.04	12.57	12.99						
797	2455709.49	10.41	12.04	12.57	13.01						
798	2455709.493	10.40	12.04	12.58	12.99						
799	2455709.495	10.42	12.04	12.57	13.00						
800	2455709.497	10.42	12.04	12.57	13.01						
801	2455709.498	10.42	12.04	12.58	12.99						
802	2455709.5	10.43	12.04	12.56	13.01						
803	2455709.501	10.42	12.04	12.57	13.00						
804	2455709.503	10.44	12.04	12.57	13.00						
805	2455709.505	10.44	12.04	12.56	13.00						
806	2455709.506	10.45	12.04	12.56	13.00						
807	2455709.51	10.45	12.04	12.56	13.01						
808	2455709.511	10.45	12.04	12.57	13.00						
809	2455709.513	10.47	12.05	12.57	12.99						
810	2455709.514	10.47	12.04	12.56	13.02						
811	2455709.516	10.48	12.04	12.57	12.99						
812	2455709.518	10.49	12.04	12.56	13.02						
813	2455709.519	10.48	12.04	12.56	13.02						
814	2455709.521	10.49	12.04	12.57	13.01						
815	2455709.523	10.51	12.04	12.57	13.00						
816	2455709.526	10.52	12.04	12.56	13.01						
817	2455709.527	10.53	12.04	12.57	13.01						
818	2455709.529	10.53	12.03	12.56	13.02						
819	2455709.531	10.53	12.04	12.58	13.00						
820	2455709.532	10.54	12.04	12.56	13.01						
821	2455709.534	10.54	12.04	12.57	13.00						
822	2455709.536	10.55	12.04	12.55	13.02						
823	2455709.537	10.56	12.04	12.56	13.00						
824	2455709.539	10.56	12.04	12.57	12.99						
825	2455709.542	10.57	12.05	12.55	13.00						
826	2455709.544	10.59	12.05	12.56	13.00						
827	2455709.545	10.60	12.04	12.57	13.01						
828	2455709.547	10.61	12.04	12.56	13.00						
829	2455709.549	10.60	12.02	12.56	13.05						
830	2455709.55	10.62	12.03	12.57	13.01						
831	2455709.552	10.62	12.03	12.57	13.01						
832	2455709.553	10.61	12.04	12.56	13.01						
833	2455709.555	10.61	12.03	12.57	13.02						
834	2455709.558	10.63	12.04	12.57	13.00						
835	2455709.56	10.64	12.04	12.56	13.00						
836	2455709.562	10.65	12.03	12.58	13.00						
837	2455709.563	10.67	12.05	12.55	13.00						
838	2455709.565	10.67	12.04	12.55	13.03						
839	2455709.566	10.69	12.03	12.57	13.03						

Table 10: Comparison of RV UMa parameters with published data

Star	Type	Period (d)			
RV UMa	**RRAB**	**This Work**	**GCVS**	**A.V.Solov'ev, Tadj**	**AAVSSO**
		0.468002	0.4680618	0.468062	0.46806

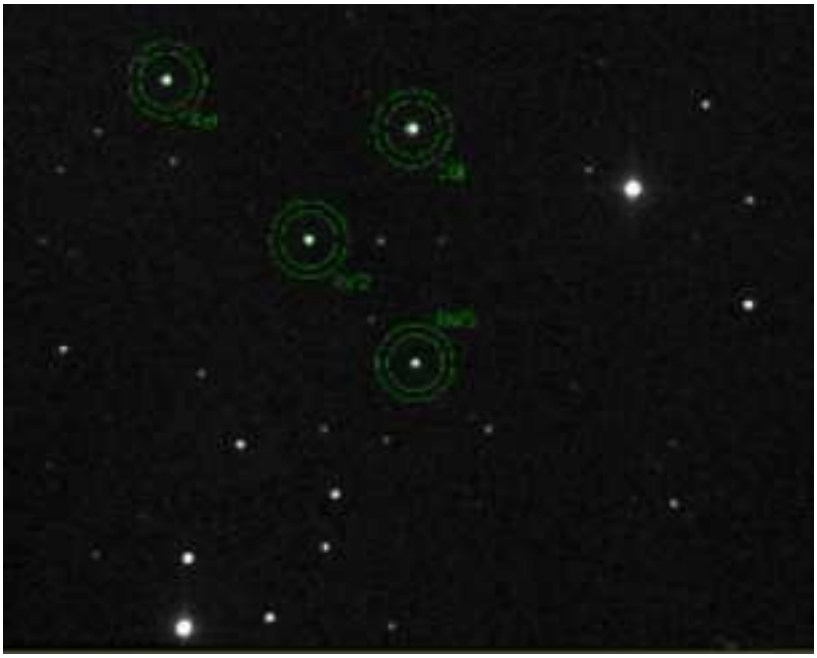


Fig.1 Map of the stars RV UMa and Ref used in this paper

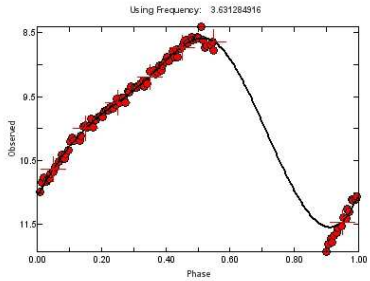


Fig 2: V Light Curve Diagram of RV UMa for this study. The scatter of the light curve is caused by Blazhko modulation. Phase 0.468002 is set to the middle of the ascending branch defined as the phase where the V flux is equal to its time averaged value.

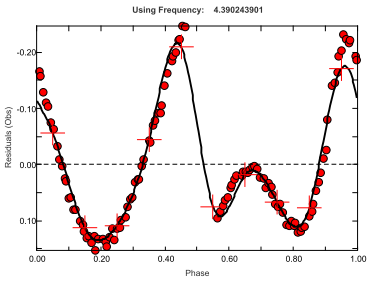


Fig 8: Residual Light Curve Diagram for this study

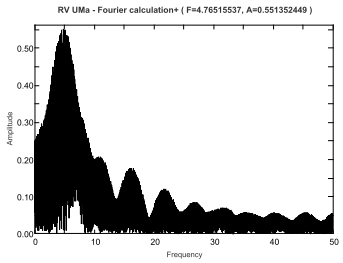


Fig 7: Fourier Diagram of the V light curve of RV UMa for this study.

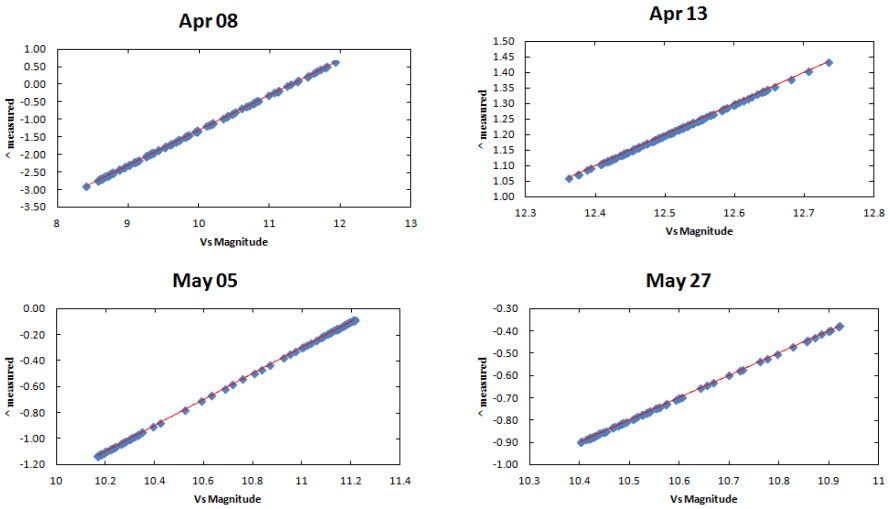
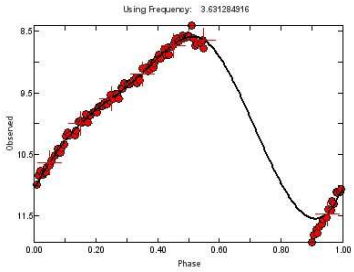
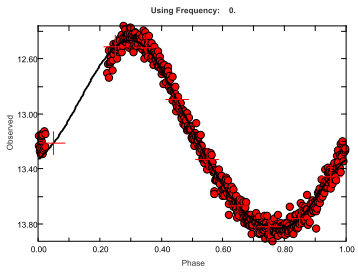
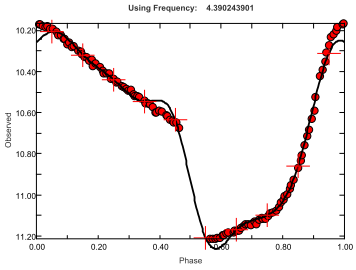


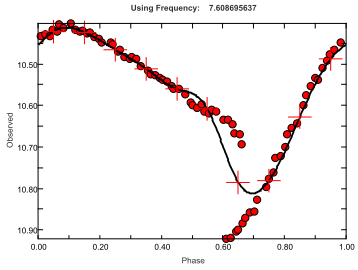
Figure 3-4-5-6: variation between instrumental measurement and value stellar catalog for each observing session



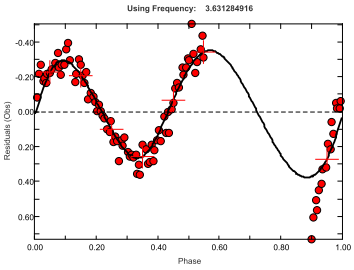


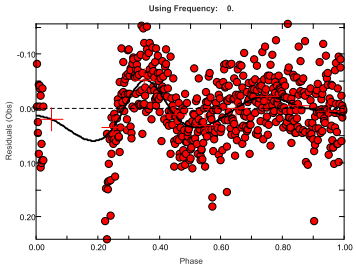
Left: Lightcurve for Apr 8, 2011 - Right: Lightcurve for Apr 13, 2011



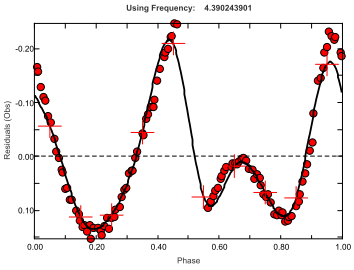


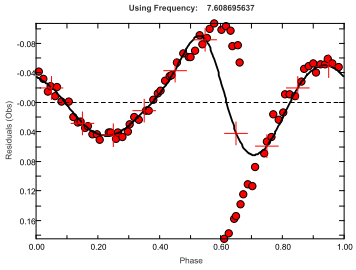
Left: Lightcurve for May 5, 2011 - Right: Lightcurve for May 27, 2011



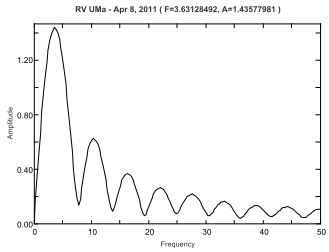


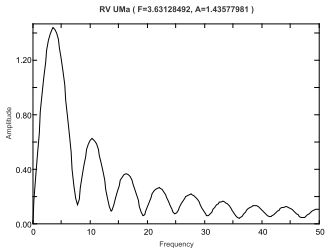
Left: Residual for Apr 8, 2011 - Right: Residual for Apr 13, 2011



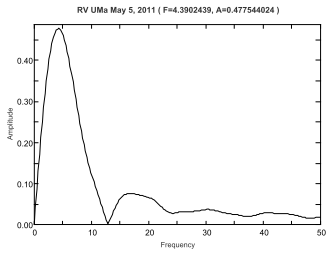


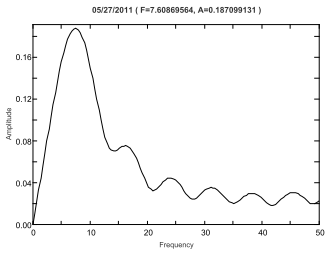
Left: Residual for May 5, 2011 - Right: Residual for May 27, 2011





Up: Fourier for Apr 8, 2011 - Down: Fourier for Apr 13, 2011





Left: Fourier for May 5, 2011 - Right: Fourier for May 27, 2011

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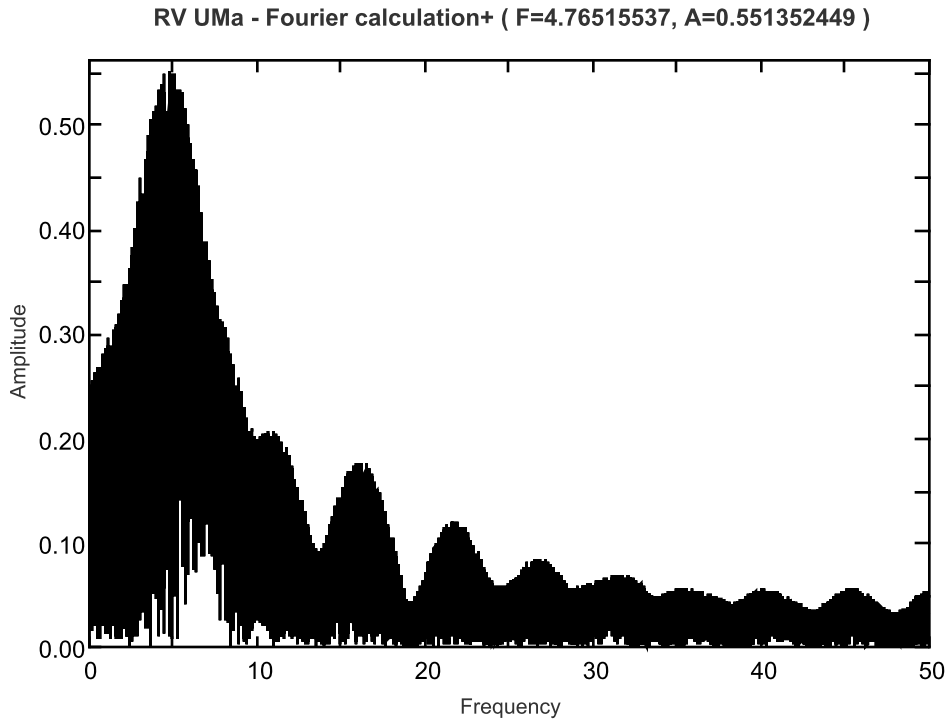

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